

DESIGN FOR A TERRA COTTA FACTORY

BY

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THESIS

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

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ENTITLED . . . DESIGN FOR A TERRA-COTTA FACTORY

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF Bachelor of Science in Architecture

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A DESIGN FOR AN ARCHITECTURAL TERRA COTTA FACTORY.

This problem is a design for a factory for the making of architectural terra cotta. It is to be large enough to supply 20 circular kilns, each 30 feet in diameter.

The plant is to be located in a large city adjacent to a railroad, the tracks of which are to be elevated.

In order to make a design of this nature, the designer must necessarily know the different processes by which the raw materials are made into the finished product. A brief description of the entire process of manufacture follows.

THE METHOD OF MANUFACTURE.

The clay that is used in the manufacture of terra cotta is shipped to the plant and is dumped into open sheds where it is exposed to the weather, and allowed to disintegrate. From here it goes to a dry pan which grinds it into small particles. It is then mixed with grit (ground pieces of terra cotta or pottery) and other products in a pug-mill. The object of mixing grit with the clay is to give the finished product the correct plasticity, shrinkage, and density. The mixed clay is forced out of the pug mill in the shape of a square bar which is cut off at convenient lengths. The resulting pieces are piled up and covered with a wet cloth to keep them damp until the clay is needed.

The clay is then molded into the desired shape. This is done by several methods, depending upon conditions.

When only one piece of a certain shape is desired, it is made directly by the modeler in clay. Often a certain piece or shape is repeated very many times. In this case the piece is made by the use of molds. The molds are made of plaster of Paris, and one mold is enough to make a large number of pieces. In this way the price of material is very much diminished. The clay is pressed by hand into the molds, and is spread over the entire surface to a thickness of one and one-half inches. The sides are then connected by clay walls of the same thickness. The mold is then allowed to stand for a time until the clay shrinks enough to allow its being taken out.

When there are a great number of pieces with straight lines in one direction only, such as string courses, a machine can be

used with great advantage. The clay is forced through a steel die of the required form and is then cut off by wires to the required length.

Some pieces require slight changes after being molded, not enough, however, to make it necessary to make a separate mold. These pieces are pressed in the regular mold, and cut with a knife and other tools to the required shape.

In all of the different processes mentioned, the pieces are made hollow to expediate drying, to save weight and material, and to cause an equal shrinkage in burning.

After the clay has been rather roughly shaped by either of the above methods, it is allowed to stand and dry from one to four days, depending upon the size, until it is stiff enough to be "finished", i. e. all minor defects in the evenness and shape corrected by the proper tools.

The piece is then placed in dry boxes. These are rooms through which hot air is forced. The piece remains in these rooms until all the water of solution has been taken out, which again takes from one to four days. The piece must be thoroughly dry before entering the kilns, otherwise it is likely to shrink unevenly or have cracks.

After pieces are thoroughly dry, they are subjected to different processes according to the requirements of the finished products. In large plants it is economical to mix quantities of only two or three kinds of clay, which, when finished will each produce a certain color. If a color, other than one of these, is desired in the finished, it is obtained by spraying what is known as a "slip" on the dried piece. A "slip" is a liquid solution of

clay and water containing the necessary color materials to give the piece when finished, the desired color. Some pieces are glazed. Glaze is merely a poor quality of glass and shows the color of the underneath. The glaze is put on in the same manner as the slip. Other pieces are enameled. Enamel is put on the piece in the same manner, and is similar to glaze, except that it is rendered opaque by the use of certain chemicals.

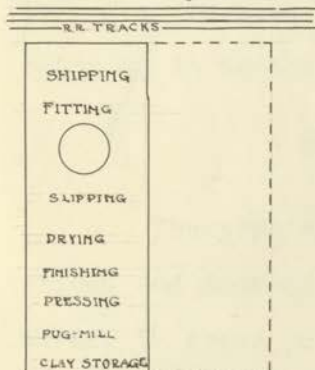
After the pieces have gone through either one of these processes, they are taken to the kilns. They remain in the kilns about thirteen days. The first third of the time is used in gradually heating the kilns to the maximum temperature, which is retained for another third, and in the remaining third of the time the kiln is allowed to cool gradually. The pieces are then taken out, and are ready for the fitting room. Due to the fact that some pieces shrink more than others when burning and drying, it is difficult to get the finished product the desired length. To remedy this, the pieces are made so that they are somewhat too long. In the fitting room they are fitted together as they are to come on the building and the projecting edges are chiseled off. After this, the piece is stored away awaiting the shippage, or immediately shipped as the case might be.

The above is a short description of the process of manufacture. To this must be added the method of making drawings, and from these drawings, molds. The architect's drawings are redrawn at an inch scale usually. In these drawings the main thing is the jointing of the different pieces. They should be made to repeat one shape as often as possible. From these drawings, detail drawings are made at large scale, showing the pieces as they are to be

on the building. The molds are made from these drawings, and are given the correct dimensions by means of a shrinkage scale. This scale is somewhat longer than an ordinary scale, but similarly divided, thus making allowance for the shrinkage of clay in drying and burning.

ONE STORY PLAN.

In designing a terra cotta factory, probably the first point to be considered is the value of the land where the factory is to be located. This fact decides whether the plant is to be one or several stories high. A one-story plan is most economical if the land is cheap, on account of being cheaper to build and also because it does away with elevating materials from floor to floor. If a plant of this sort can be located near to the clay grounds, it does away with the expense of shipping the clay to the factory.



The ideal arrangement for a one-story plan is shown by the accompanying sketch plan. In this method of planning a kiln and the necessary rooms for the other processes form a unit. In order to enlarge a plant of this sort, it is only necessary to add another unit as indicated by the dotted lines.

The clay is brought to the clay storage-sheds by small cars, and from there goes to the pug mill and so on through the successive steps, until it is ready to be shipped when it is placed in the shipping rooms which are adjacent to the railroad tracks. Each successive step in the manufacture takes the piece nearer to the railroad track, thus dispensing with unnecessary hauling of material.

In case a large plant is needed, the units could be repeated on the opposite side of the railroad tracks. This would keep the plant from stretching out too far in one direction, and would make the centralization of power more effective. The power plant, molding rooms, drafting room, and offices would be arranged

according to the size of the plant, in front of the factory proper.

The advantages of this management are as follows:-

- (a) The economy of building in one story.
- (b) The saving of power in doing away with elevating of materials.
- (c) In making the use of skylights practical, thus giving good light courts.
- (d) Each successive step bringing the piece nearer to the tracks, which is the natural and economical arrangement.
- (e) The nearness of the clay doing away with the expense of shipping it to the plant.

PLAN OF SEVERAL STORIES.

The problem of designing a plant where the land is high-priced and does not permit the one story solution, is more complicated. In order to get the necessary arrangement, the designer must know all of the different parts which go to make up a large plant. The number and size of the kilns will determine the size and arrangement of the plant. The following list will give the different parts of a large factory. The approximate floor areas of the different parts correspond to one circular kiln 33 feet in diameter are also given.

Administration Building.

Offices	150 sq. ft. per kiln.
Exhibition room	50 " " " "
Drafting "	300 " " " "
Estimating "	100 " " " "
Blue Print "	30 " " " "
Photography "	30 " " " "

Process Building.

Pressing Room	2250 sq. ft. per kiln.
Finishing "	2250 " " " "
Drying "	600 " " " "
Slipping "	2200 " " " "
Kiln storage	1000 " " " "
Burnt Ware Storage	1400 " " " "
Fitting Room	1300 " " " "
Shipping "	1800 " " " "
Mold "	1000 " " " "
Modeling "	300 " " " "

Power Building.

Boiler Room	150 sq. ft. per kiln.
Engine "	150 " " " "
Coal "	30 " " " "
Iron Shop	80 " " " "
Wood "	90 " " " "
Pug mill Room	700 " " " "
Clay storage	600 " " " "

Sheds.

Coal sheds	300 sq. ft. per kiln.
Clay sheds	1500 " " " "
Broken pottery sheds	200 " " " "
Old mold sheds	1000 " " " "

Ceramics department.

Laboratory	80 sq. ft. per kiln.
Kiln	
Chemical storage	25 " " " "
Stables	300 " " " "

Administration Building.

The administration building should be so located as to have good light, pleasant surroundings if possible, and be separated from the main building. In a large plant it is desirable to have an exhibition room for visitors. The offices should be in close connection with the estimating and drafting rooms. These should contain large vaults for the storage of drawings. Lockers and toilets should be provided.

Process Building.

The process building should be arranged to allow the piece to go through the different steps of manufacture, with the least amount of haulage and power. The pressing and finishing departments should be adjacent and preferably in one room. Space must be allowed for the pieces to stand before entering the dry boxes which should be in connection with the finishing room: they may be on the same floor with the latter, or directly below, with the slipping department. The dry boxes should be kept together as much as possible to economize on heat. The slipping and glazing department should be provided with space for the storage of the pieces ready to go into kilns. From the kilns the pieces go to a storage room where they stay until they are fitted. This storage room should be in connection with kilns, and should lead to the fitting department. A storage room for ware ready to be shipped should also be provided near the fitting room. This storage room should be located to be convenient in loading cars on a side-track, or of wagons. The modeling room should have good light, and should be near the molding and drafting rooms. This room must be about 20 feet high to allow the making of larger pieces. Offices, toilets

lockers, etc. should be provided in this building.

Power Building.

It is desirable to have all large, heavy machinery in this building so as to be near the source of power, and also not to disturb the workmen by noise and vibration. The pug mill, if of the vertical type will extend up through four stories. It should be directly connected with storage for the prepared clay. This can be accomplished by turning the basement of the power building into a storage room.

Kilns.

Kilns probably operate somewhat better if placed in a building, but this is rather expensive so usually they are merely enclosed by the buildings. This shelters them from the wind which is detrimental to the proper burning of terra cotta. In arranging the kilns and the yards around about them, ample space should be left between them to permit of hauling material to and from them. The kilns are usually built so as to be fired from the ground. This makes it necessary to have an opening high enough to permit a man to walk underneath the platforms, upon which the ware is taken to and from the kilns.

Ceramics Department.

The ceramics department may be placed at any convenient place, as it has no special connection with any part of the plant, but is merely for experimental work.

Stables.

The stables should be located near the street, and should not have rooms for the keeper in connection with them.

Sheds.

The clay and coal sheds should be located along a side-track, and be connected with the rest of the plant by means of small tracks. All of these sheds except those for iron storage should be open on the sides with a roof above. The sheds for the storage of old molds may be at any vacant place as the molds are not used very often, after they are stored there. It should have an office in connection where the molds can be cataloged. The sheds for iron and lumber storage should be convenient to the iron and wood shops. These should be closed.

Tracks.

The railroad tracks are to be elevated.